Abstract Number: 1966
Submission Type: ESOC2026 - Regular Abstract Submission
Abstract Title: DEEP-LEARNING-NETWORK ANALYSIS OF STROKE ON BRAIN SECTIONS: THE STROKEANALYST-2
Abstract Topic: 07.00 - DIGITAL TRANSFORMATION, AI AND ROBOTICS
Abstract Subtopic: 07.01 - TECHNOLOGY INNOVATIONS: ROBOTS, VIRTUAL REALITY, ARTIFICIAL INTELLIGENCE AND MORE
Preferred Presentation Type: Prefer - Oral or Poster Presentation

Ioanna Gemou[1] , Panagiotis Kiousis[1] , Angelos Pavlopoulos[2] , Anastasia Papavasileiou[2] , Uta Mamrak[3] , Stefan Roth[3] , Nikolaus Plesnila[3] , Constantinos Pantos[2] , Iordanis Mourouzis[2] , Konstantinos Moustakas[1] , Athanasios Lourbopoulos[2, 3, 4]

[1] Department of Electrical & Computer Engineering, School of Engineering, University of Patras, Patra, Greece,[2] Department of Pharmacology Medical School of Athens, National and Kapodistrian University of Athens, 75 Mikras Asias Ave., 11527 Goudi, Athens, Greece, [3] Institute for Stroke and Dementia Research (ISD), University of Munich Medical Center, Munich, Greece, [4] Department of Neurointensive Care, Schoen Klinik Bad Aibling, Bad Aibling, Germany

Background and aims

Stroke quantification in rodents sections remains subjective and labor-intensive. Therefore, we advanced our machine-learning based “StrokeAnalyst-1” (SA1) to the deep-learning based “StrokeAnalyst-2” (SA2).

Methods

We used mouse brain coronal sections with stroke and compiled one training (n=1200, Nissl-stained) and 4 validation datasets (n=77: MAP2-, 2x Nissl- and TTC-stained). Manual annotation of all datasets served as ground-truth. We built SA2 to integrate deep-learning based image segmentation selecting -after several tests- a visual-transformer (ViT) network. SA2 preprocesses images of brain sections, performs background segmentation (BSG) and corrects for rotation. User-defined prompts to its ViT enable hemisphere separation and stroke detection (SSG) with corresponding output areas. We fine-tuned ViT with increasing numbers of sections and ViT-parametrization. DICE-coefficients for BSG and SSG evaluated segmentation accuracy of SA2 or common available methods for stroke analysis (manual, thresholding and hybrid ImageJ approaches, InfarctSizer and SA1) on validation sets.

Results

Existing manual and semi-automated ImageJ or InfarctSizer segmentation methods are limited by low accuracy, time-consuming, bias or non-generalizability (DICE range 0.0 - 0.97 for BSG and 0.0 - 0.91 for SSG). SA1 achieved 0.87-0.99 for BSG for all validation sets and 0.0 - 0.92 for SSG, TTC-specific as expected. Untrained ViT models achieved DICE 0.0 - 0.97 for BSG and 0.0 - 0.82 for SSG. Fine-tuning lead to plateaus with consistent DICE of 0.84 - 0.97 for BSG and variable 0.36 - 0.89 for SSG, in all validation sets, with a processing time of 2 seconds.

Conclusions

SA2 enables automated, ultra-fast, unbiased and staining-independent detection of stroke on brain sections.

Conflict of interest: All authors: nothing to disclose

Travel Grant Application: No

Young Investigator Award Application: No